T1 radiation environment

M. Huhtinen

TOTEM T1 EDR, CERN,
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Mika Huhtinen
CERN/PH-CMG

Scaling

For consistency all results are scaled to:

1 s at luminosity 10^{34}

= 10 nb^{-1} = 8E8 pp-collisions

(After all - these are CMS radiation simulations)

Describing the environment

For radiation effects we (normally*) need 3 quantities:

1) Hadron fluence (n+ch) above 100 keV for Si bulk damage

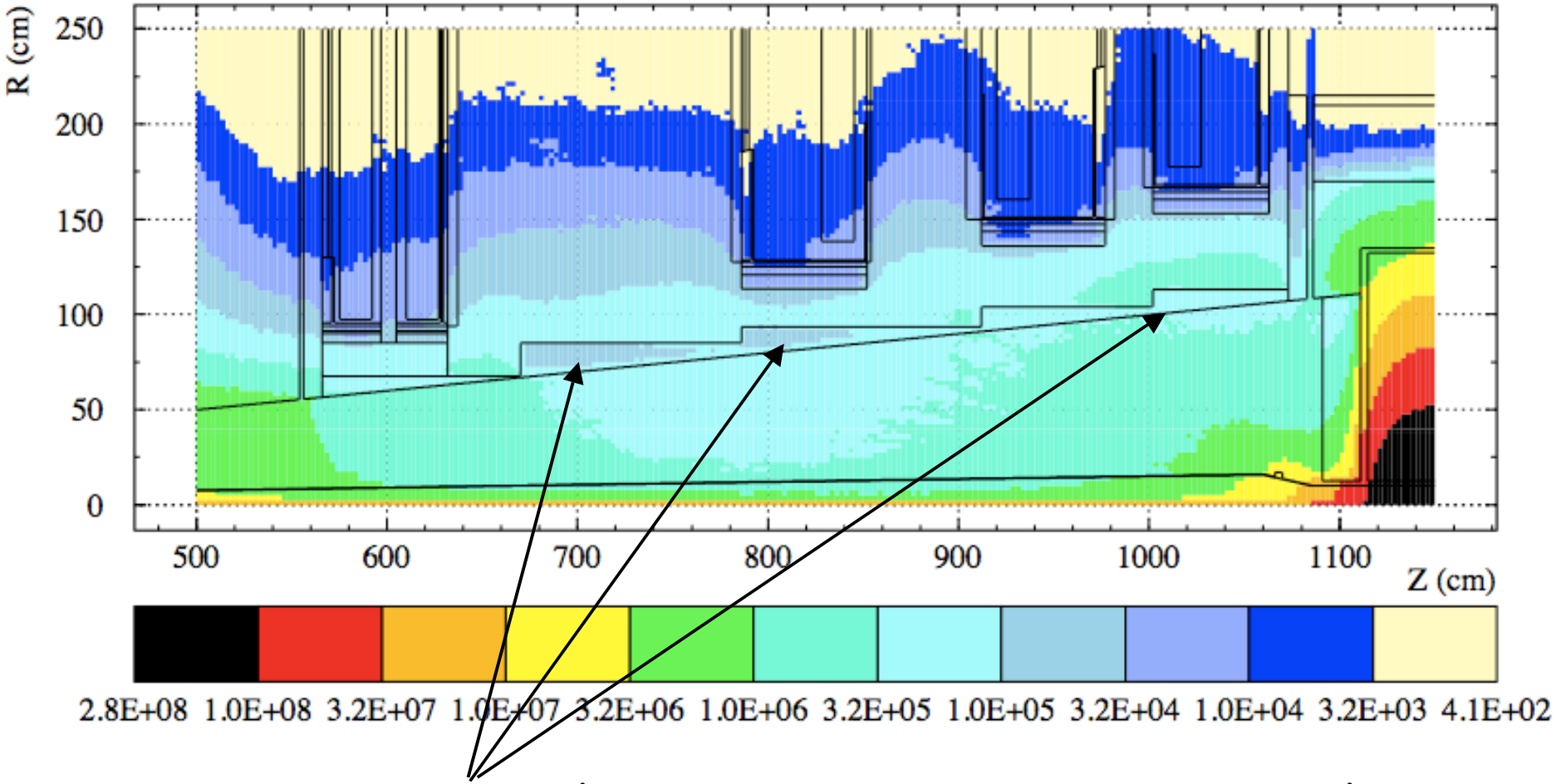
2) Hadron fluence above 20 MeV for SEU

3) Absorbed dose for surface damage (esp CMOS devices)

And I guess for occupancy studies the charged flux might be of interest

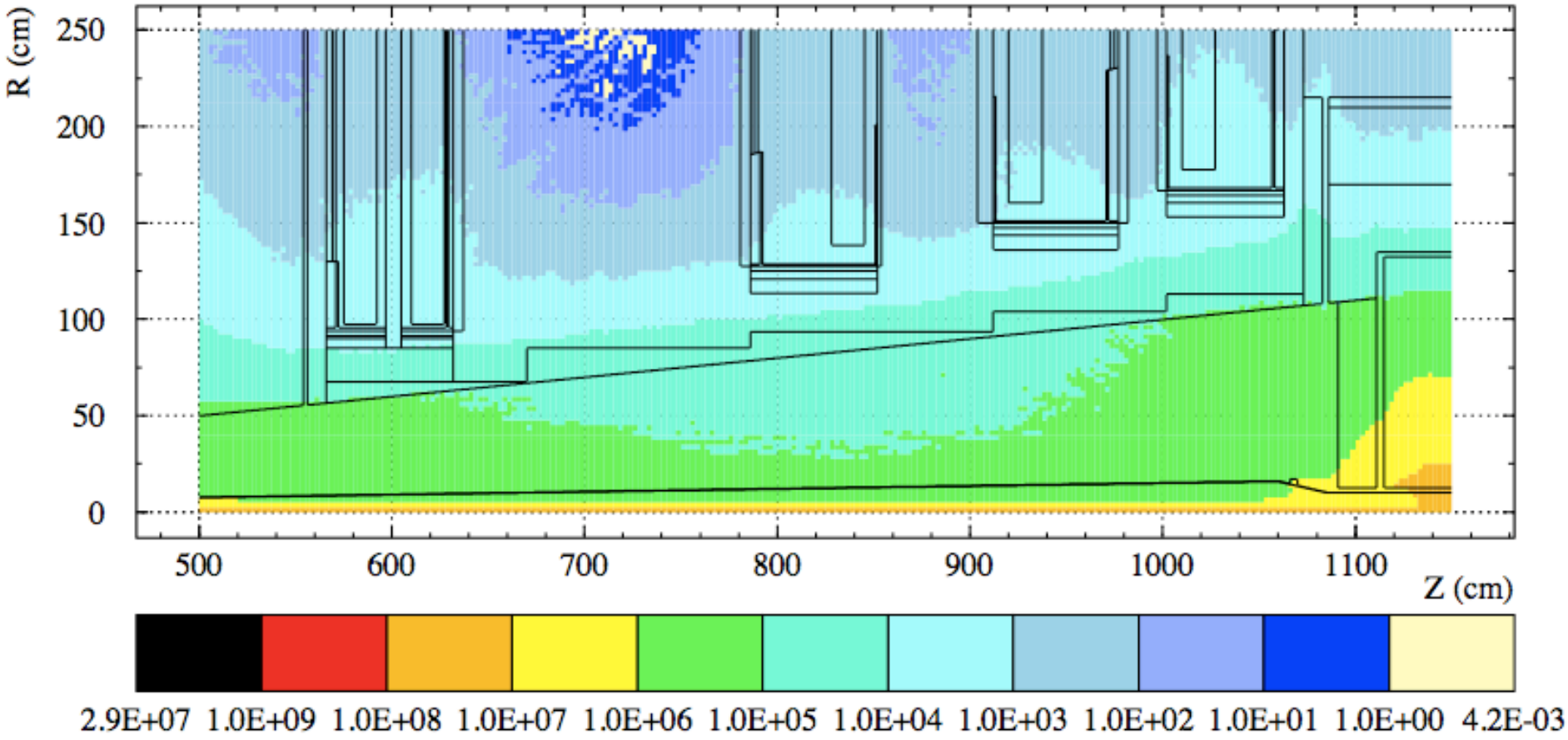
*I do not really know about damage in the GEMs

>100 keV neutrons

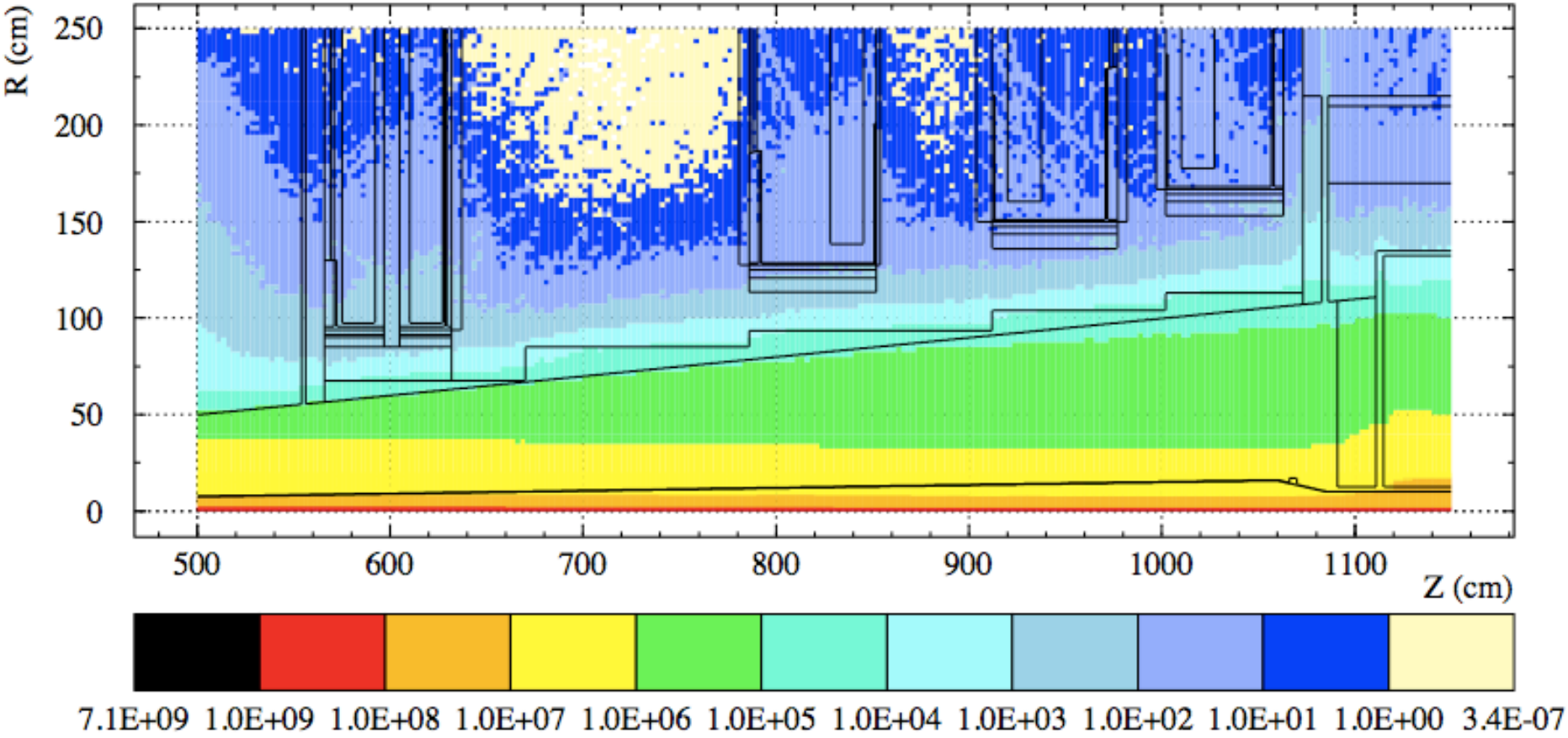


Polyethylene (reduces flux, but not there with T1 !)

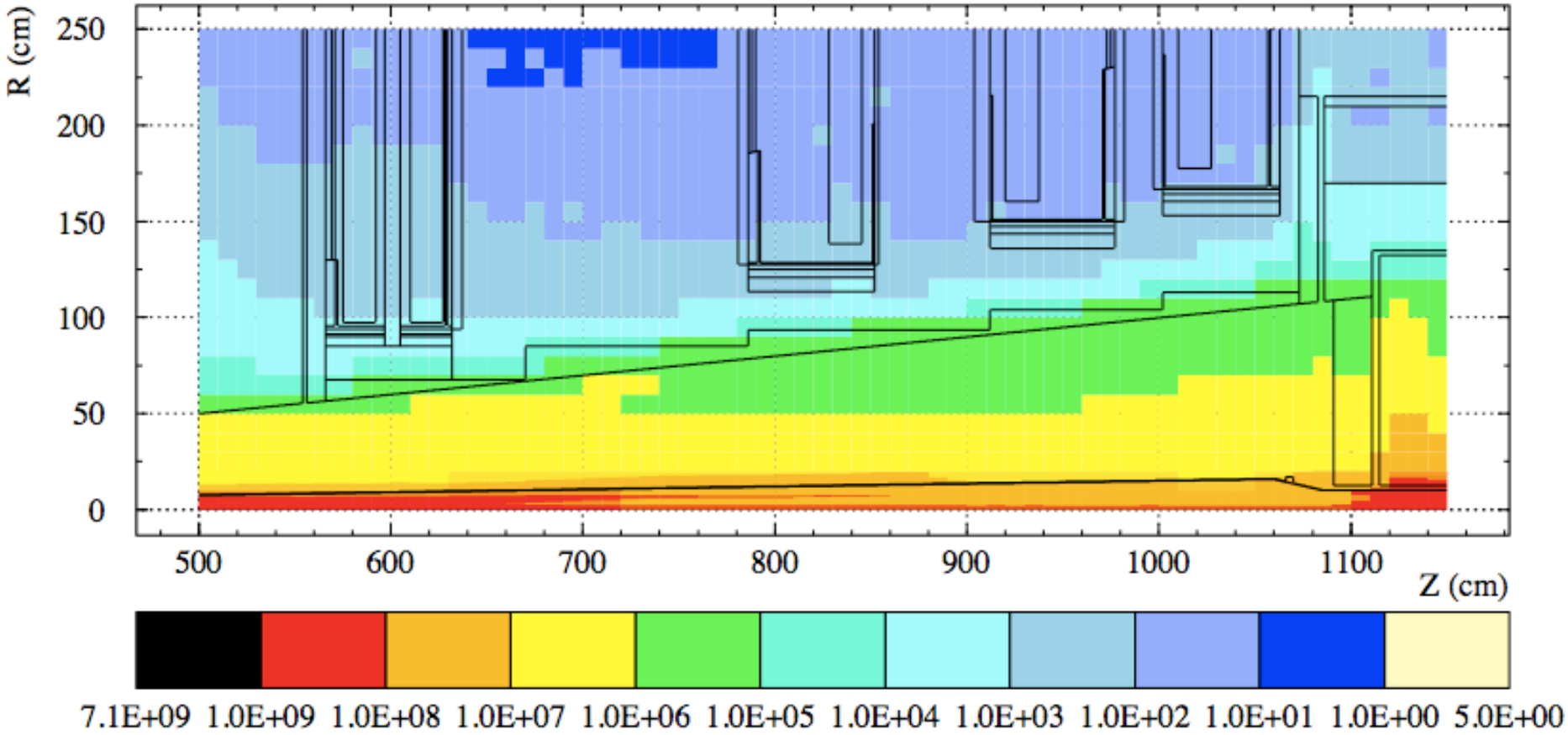
>20 MeV neutrons



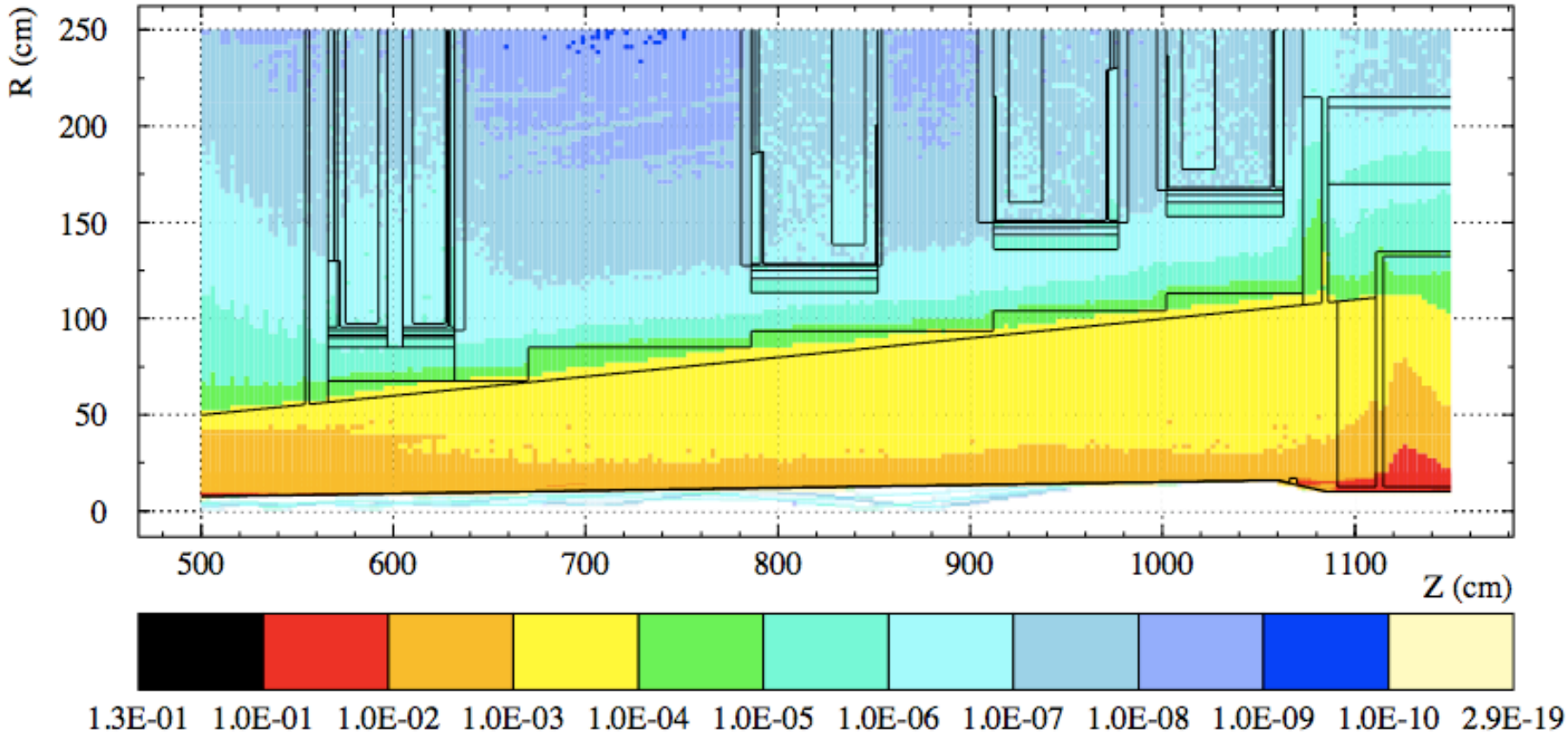
Ch. Hadron fluxes



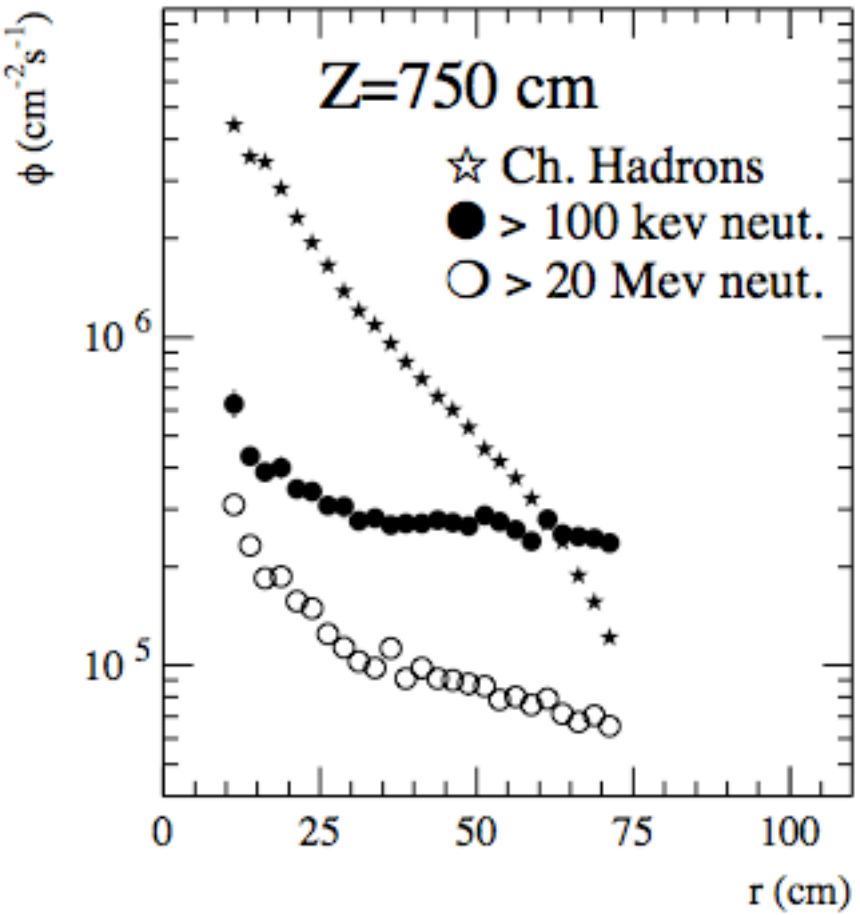
Charged flux (e+chh)

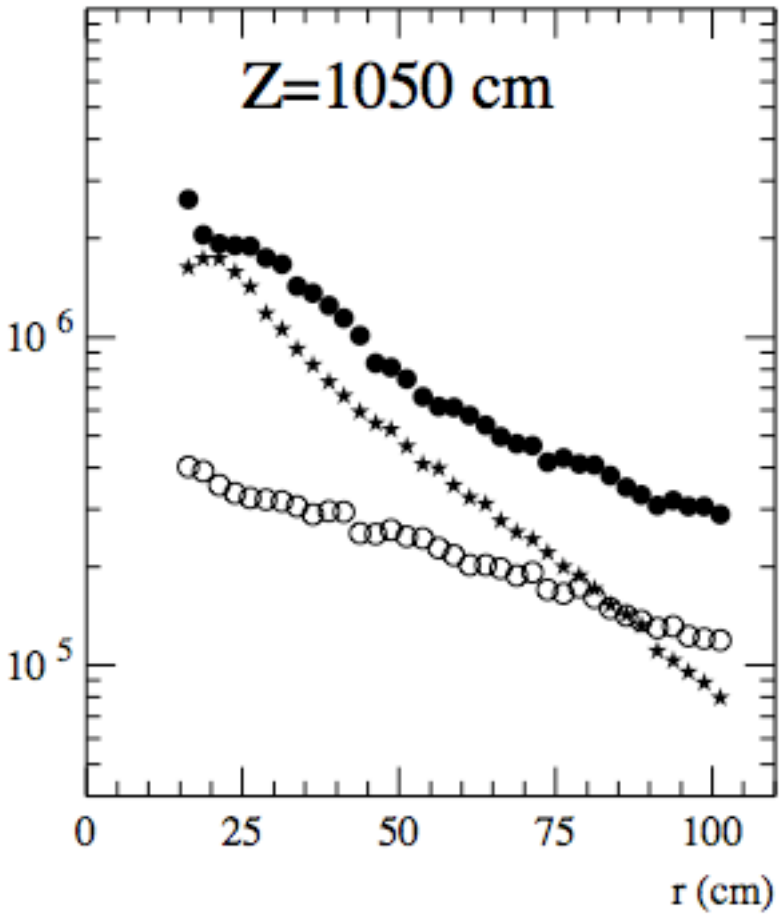


Dose

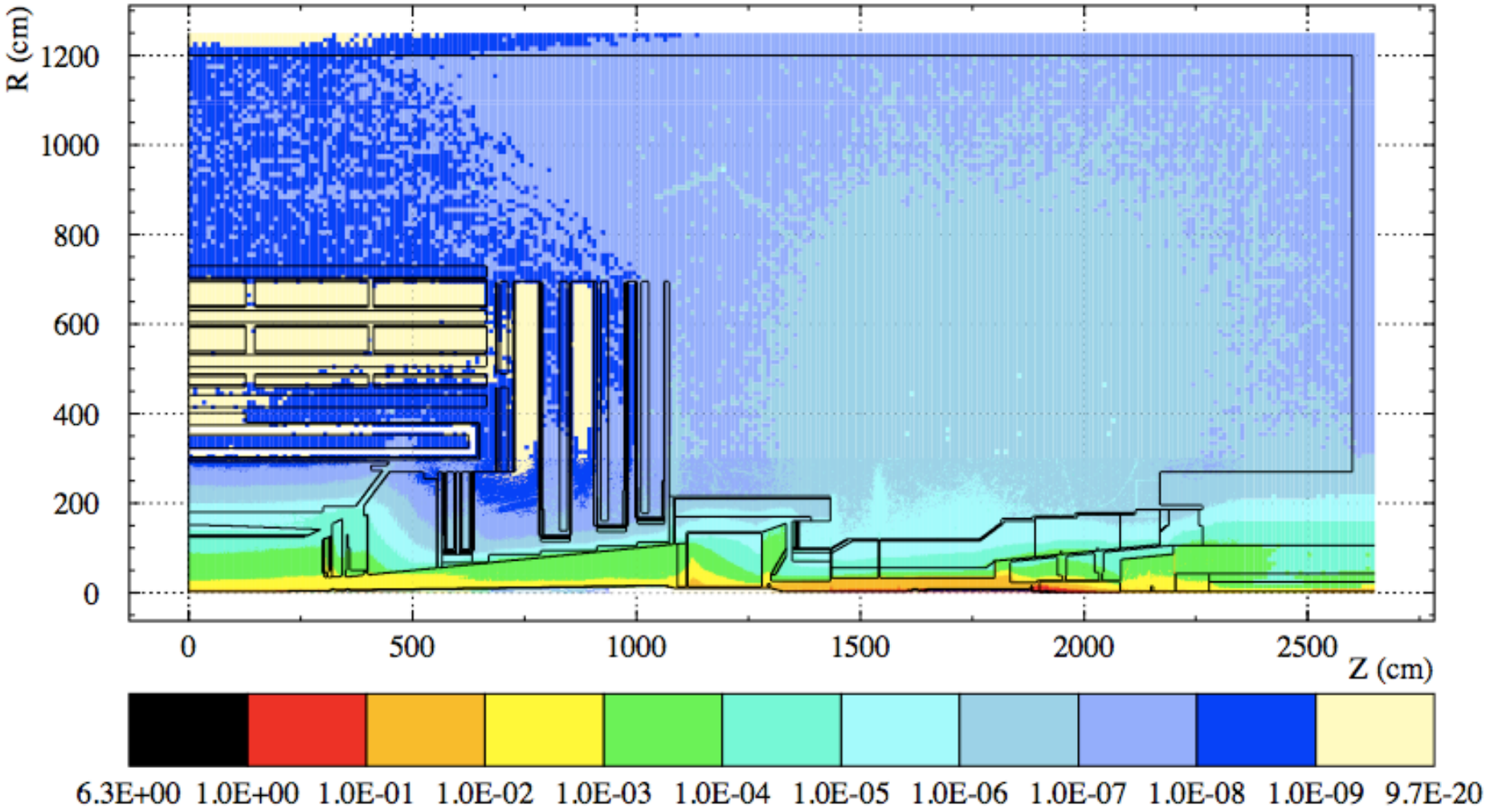

R (cm)
250
200
150
100
50
0
500
600
700
800
900
1000
1100
Z (cm)
1.3E-01
1.0E-01
1.0E-02
1.0E-03
1.0E-04
1.0E-05
1.0E-06
1.0E-07
1.0E-08
1.0E-09
1.0E-10
2.9E-19

Flux vs. Radius





Dose on UXC (Gy/s)

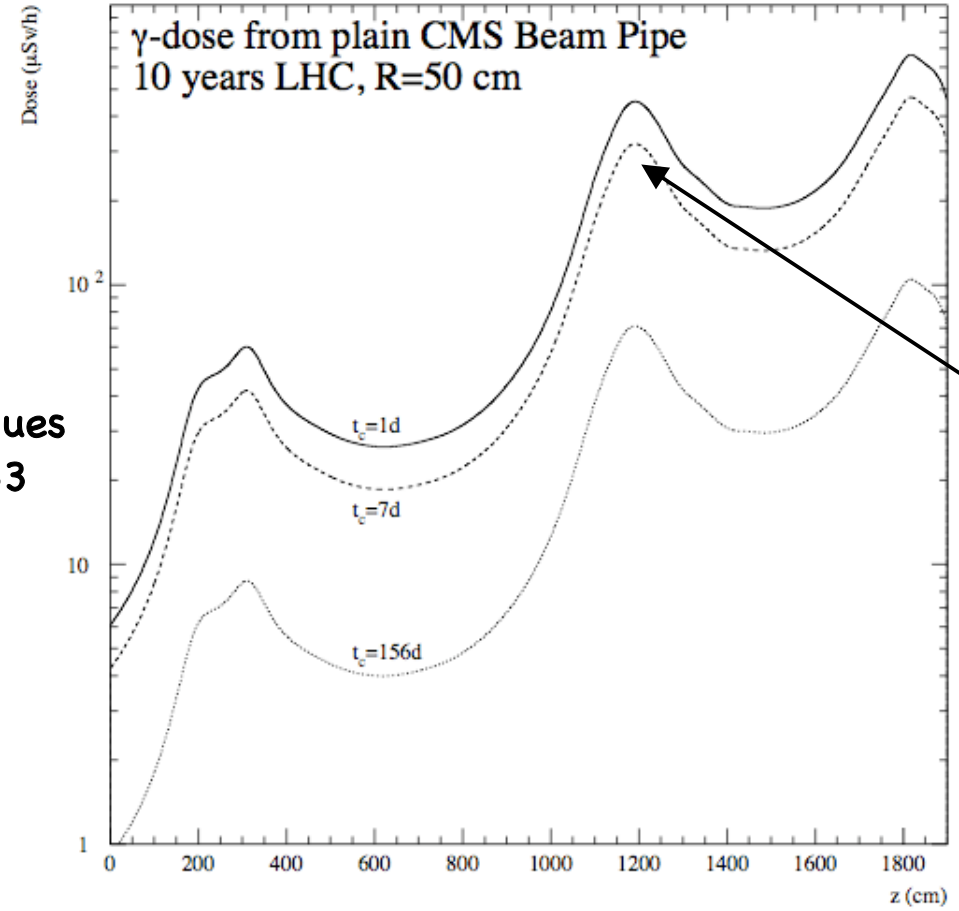


Induced radioactivity

Sure, luminosity is low and T2 is worse…

…but do not forget the beam-pipe (once L of order 1E33)

Assume 10% of these values after first year at 1E33



T1 extraction in this region (in space and time)

Conclusions

Fluxes comparable to CMS Tracker

But of course the lower luminosity (how much lower?) helps

Same technology as CMS EMU CSC…

But 2-3 order of magnitude more radiation !

Beware of SEU:s and other rate-related effects
once $L \gtrsim 10^{32}$